

REMARKS

Before entry of this paper, the status of the application according to the pending Office action is as follows:

- Restriction to one of the following inventions is required under 35 U.S.C. § 121: (I) claims 1-26, drawn to an apparatus for fabricating a three-dimensional object; or (II) claim 27-42, drawn to a method for fabricating a three-dimensional object.
- Claims 1-3, 5-6, 10-14, 16-20, and 22-26 are rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,637,175 to Feygin *et al.* (hereinafter “Feygin”).
- Claims 1-3 are rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,837,960 to Lewis *et al.* (hereinafter “Lewis”).
- Claims 22-26 are rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent Publication No. 2002/0047229A1 to Yanagisawa *et al.* (hereinafter “Yanagisawa”).
- Claim 4 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Feygin in view of U.S. Patent No. 6,612,824 to Tochimoto *et al.* (hereinafter “Tochimoto”).
- Claims 7-9 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Feygin in view of U.S. Patent No. 6,841,116 to Schmidt (hereinafter “Schmidt”).
- Claim 15 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Feygin in view of U.S. Patent No. 6,658,314 to Gothait (hereinafter “Gothait”).
- Claim 21 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Feygin in view of German Utility Model No. DE 299 07 262 to EOS GmbH (hereinafter “EOS”).

Applicants hereby amend claims 1-5, 7-11, 14, 17-18, 21, and 22-26. Claims 1, 4, 7, 17, 18, and 22 are amended to more clearly define the subject matter of the invention. The

amendments are fully supported at least at paragraphs [0046]-[0049], [0052], and [0069], and FIGS. 1, 4, 5A, and 7A. Claims 2-3, 5, 8-11, 14, and 23-26 are amended for consistency. No new matter is added thereby.

In view of the above amendments and following remarks, Applicants respectfully request reconsideration and withdrawal of all grounds of rejection and passage of claims 1-26 to allowance in due course.

1. Restriction to one of the following inventions is required under 35 U.S.C. § 121: (I) claims 1-26, drawn to an apparatus for fabricating a three-dimensional object; or (II) claim 27-42, drawn to a method for fabricating a three-dimensional object. With this Amendment and Response, Applicants hereby affirm election of the claims identified in the Office action as Group I, claims 1-26. Claims 27-42 are hereby cancelled, without prejudice.

2. Claims 1-3, 5-6, 10-14, 16-20, and 22-26 are rejected under 35 U.S.C. § 102(b) as being anticipated by Feygin. Applicants respectfully traverse this rejection as applied to the claims, as amended.

Feygin appears to disclose laminated object manufacturing (LOM) methods and apparatus for use with powder and sheet materials. The laminations can be formed prior to being added to a stack or formed on a stack. Col. 19, ll. 29-45, of Feygin. As described in col. 12, line 40 to col. 13, line 5 of Feygin, a powder based method involves forming a layer of material by compression on a platform 2 and then using a laser 7 to “print” the cross-sectional lamination in the shape of the object. Printing appears to be related to cutting, bonding or fusing the material using the laser 7, or other concentrated energy means (col. 13, ll. 61-66) or concentrated jets of matter (col. 14, ll. 5-6).

Applicants' amended independent claim 1 recites a "rotary annular build drum for receiving successive layers of a build material therein" and an array of at least one printhead, where "the at least one printhead is configured for selectively dispensing droplets of a liquid binder onto the build material." Applicants respectfully submit that Feygin fails to be a proper anticipatory reference to Applicants' independent claim 1, at least because Feygin does not teach or suggest such a structure.

Specifically, there is no disclosure in Feygin of a rotary annular build drum for receiving build material therein. The rotary table 39 depicted in FIG. 10 and described at col. 24, ll. 45-51 is a platform that moves an enclosure 17 around a circular path to various stations of the apparatus. The rotary table itself is not annular and does not receive the build material therein. The enclosure 17 appears to be fixed to the table, which is rotated to move the enclosure to the various stations, at one of which the enclosure receives build material. The enclosure itself, however, is neither annular nor rotary.

Furthermore, Feygin does not disclose at least one printhead configured for selectively dispensing droplets of a liquid binder onto the build material. The apparatus of the present invention forms 3D parts by a fundamentally different method than the apparatus of Feygin. Feygin relies on concentrated energy means, e.g., lasers, and concentrated jets of matter. Nowhere in Feygin is the selective dispensing of droplets of a liquid binder disclosed.

Thus, Feygin does not teach or suggest a "rotary annular build drum for receiving successive layers of a build material therein" or at least one printhead configured for "selectively dispensing droplets of a liquid binder onto the build material," as recited in Applicants' independent claim 1.

Similarly, Applicants' amended independent claim 22 recites an "annular build drum for receiving successive layers of a build material therein" and at least one printhead configured for "selectively dispensing droplets of a liquid binder." As discussed with respect to claim 1, Feygin fails to teach or suggest an annular build drum for receiving build material therein or at least one printhead configured for selectively dispensing droplets of a liquid binder. Thus, Applicants' amended independent claim 22 is also patentable over Feygin.

Accordingly, Applicants respectfully submit that independent claims 1 and 22 are allowable over Feygin. Because claims 2-3, 5-6, 10-14, 16-20, and 23-26 depend, either directly or indirectly, from either independent claim 1 or independent claim 22, and include all of the limitations thereof, Applicants respectfully submit that these claims are allowable as well.

Further, Applicants' dependent claim 18 recites a sensor to monitor at least one performance characteristic of the apparatus, wherein the characteristic is selected from the group consisting of print quality, printing errors, print speed, printhead condition, and drum position." Applicants respectfully submit that Feygin fails to teach or suggest such a structure. Rather, Feygin at col. 30, ll. 4-50, as cited in the Office action, teaches sensing the height of the stack of laminations. Feygin is silent with respect to monitoring printing errors, print speed, printhead condition, or drum position. Accordingly, Applicants respectfully submit that dependent claim 18 is independently allowable over Feygin.

Applicants respectfully request reconsideration and withdrawal of the rejection of claims 1-3, 5-6, 10-14, 16-20, and 22-26 under 35 U.S.C. §102(b) based on Feygin.

3. Claims 1-3 are rejected under 35 U.S.C. § 102(b) as being anticipated by Lewis. Applicants respectfully traverse this rejection as applied to the claims, as amended.

Briefly, Lewis appears to disclose a method and apparatus for forming articles from materials that are melted by a laser beam. Col. 3, ll. 25-29, of Lewis. The articles are formed by the deposition of molten materials, where powder materials are provided to a deposition zone along paths disposed about the laser beam, thereby forming a pool of molten material in the deposition zone. The molten material is deposited on to article supports where the molten material solidifies. Col. 4, ll. 22-50.

Applicants' independent claim 1 recites a "rotary annular build drum for receiving successive layers of a build material therein" and an array of at least one printhead, where "the at least one printhead is configured for selectively dispensing droplets of a liquid binder onto the build material." Applicants respectfully submit that Lewis fails to be a proper anticipatory reference to Applicants' independent claim 1, at least because Lewis does not teach or suggest such a structure.

In contrast to Applicants' claimed invention, Lewis discloses using a laser to melt various materials, thereby creating molten materials, which are deposited along a tool path and allowed to cool. Col. 5, l. 52, to col. 6, l. 28. Lewis does not teach or suggest a printhead configured to selectively dispense droplets of a liquid binder onto the build material to form a 3D object.

Furthermore, Lewis does not disclose an annular build drum for receiving build materials therein. Rather, Lewis discloses a rotary table 5 (col. 7, l. 7), but does not disclose the shape of the table. In addition, the rotary table shown in FIG. 1 of Lewis appears to have a planar top surface upon which the parts are fabricated. As such, the rotary table is not an annular build drum and does not receive build materials therein.

Thus, Lewis does not teach or suggest an "annular build drum for receiving successive

layers of build material therein” or at least one printhead configured for “selectively dispensing droplets of a liquid binder onto the build material,” as recited in Applicants’ independent claim 1.

Accordingly, Applicants respectfully submit that independent claim 1 is allowable over Lewis. Because claims 2 and 3 depend directly from independent claim 1, and include all of the limitations thereof, Applicants respectfully submit that these claims are allowable as well.

Applicants respectfully request reconsideration and withdrawal of the rejection of claims 1-3 under 35 U.S.C. §102(b) based on Lewis.

4. Claims 22-26 are rejected under 35 U.S.C. § 102(b) as being anticipated by Yanagisawa. Applicants respectfully traverse this rejection as applied to the claims, as amended.

Briefly, Yanagisawa appears to disclose stereolithographic shaping methods. The methods involve coating a surface of a shaped article with an optically-curable resin. The resin preferably cured by the use of a laser beam. Paragraphs [0020]-[0022], of Yanagisawa.

Applicants’ independent claim 22 recites an “annular build drum for receiving successive layers of a build material therein” and an array of at least one printhead, where “the at least one printhead is configured for selectively dispensing droplets of a liquid binder onto the build material.” Applicants respectfully submit that Yanagisawa fails to be a proper anticipatory reference to Applicants’ independent claim 22, at least because Yanagisawa does not teach or suggest such a structure.

In contrast to Applicants’ amended claim 22, Yanagisawa teaches a flat shaping table 96 upon which layers are shaped. The supporting surface of the table 96 can also have a cylindrical shape. Paragraphs [0077]-[0081], of Yanagisawa. Yanagisawa does not teach an “annular build drum” or any other type of receptacle for receiving build material “therein,” as the build material

of Yanagisawa appear to be deposited on an exterior surface of the shaping table of Yanagisawa.

In addition, Yanagisawa discloses using an optically-curable resin as a build material, which is coated onto shaped articles and then cured by use of a laser beam. In distinct contrast, Applicants' amended independent claim 22 recites at least one printhead configured for "selectively dispensing droplets of a liquid binder onto the build material," to print an object.

Accordingly, Applicants respectfully submit that independent claim 22 is allowable over Yanagisawa. Because claims 23-26 depend directly from independent claim 22, and include all of the limitations thereof, Applicants respectfully submit that these claims are allowable as well.

Therefore, reconsideration and withdrawal of the rejection of claims 22-26 under 35 U.S.C. §102(b) based on Yanagisawa are respectfully requested.

5. Claim 4 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Feygin in view of Tochimoto. Applicants respectfully traverse this rejection as applied to the claims, as amended.

Briefly, Tochimoto appears to describe an apparatus for molding 3D objects. The apparatus includes multiple nozzles for jetting different materials to mold the object. Col. 2, ll. 20-35, of Tochimoto. The apparatus further includes a plurality of tanks 38 for holding resins having different melting points and a plurality of tanks 40 for holding inks having different color components. The resins and inks are delivered to a nozzle head 35 having multiple nozzles. Col. 14, ll. 12-41. The different resins or inks can be jetted simultaneously from separate nozzles during the molding process. Col. 18, ll. 46-55.

Applicants respectfully submit that the disclosure of Tochimoto fails to cure the deficiencies of Feygin with respect to independent claim 1, as outlined in section 2 above.

Specifically, Tochimoto also fails to teach, suggest, or motivate one skilled in the art to contemplate a “rotary annular build drum for receiving successive layers of a build material therein” and an array of at least one printhead, where “the at least one printhead is configured for selectively dispensing droplets of a liquid binder onto the build material.”

Applicants, therefore, submit that neither Feygin nor Tochimoto, alone or in proper combination, provides the teaching, suggestion, or motivation for one skilled in the art to arrive at Applicants’ invention, as recited in amended independent claim 1.

Accordingly, Applicants respectfully submit that independent claim 1 is allowable over Feygin in view of Tochimoto. Because claim 4 depends indirectly from independent claim 1, and includes all of the limitations thereof, Applicants respectfully submit claim 4 is allowable as well.

Furthermore, Applicants’ amended claim 4 recites a “blender for mixing the build material components in a predetermined ratio prior to delivery to the annular build drum.” See, for example, Applicants’ FIG. 6B and paragraph [0072]. Tochimoto specifically discloses that the various resins and inks are maintained in separate tanks and are delivered via separate nozzles and are, at best, only mixed when delivered during the molding process. Accordingly, the various materials used in the molding process of Tochimoto are not blended prior to delivery to the build drum.

Accordingly, Applicants respectfully submit that dependent claim 4 is independently allowable over Feygin in view of Tochimoto.

Applicants respectfully request reconsideration and withdrawal of the rejection of claim 4 under 35 U.S.C. § 103(a) as being unpatentable over Feygin in view of Tochimoto.

6. Claims 7-9 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Feygin in view of Schmidt. Applicants respectfully traverse this rejection as applied to the claims, as amended.

Briefly, Schmidt appears to describe an apparatus for dispensing curable phase change materials. The apparatus includes a dispensing trolley 20 including a planarizer 32 disposed above a platform 14. Col. 12, ll. 34-44, col. 13, ll. 40-55, and FIG. 2, of Schmidt. The planarizer 32 rotates over a surface of the material and excess material is brought up to a waste receptacle 64 disposed on the trolley 20 and above the platform 14.

Applicants respectfully submit that the disclosure of Schmidt fails to cure the deficiencies of Feygin with respect to independent claim 1, as outlined in section 2 above. Specifically, Schmidt also fails to teach, suggest, or motivate one skilled in the art to contemplate a “rotary annular build drum for receiving successive layers of a build material therein” and an array of at least one printhead, where “the at least one printhead is configured for selectively dispensing droplets of a liquid binder onto the build material.”

Applicants, therefore, submit that neither Feygin nor Schmidt, alone or in proper combination, provides the teaching, suggestion, or motivation for one skilled in the art to arrive at Applicants’ invention, as recited in amended independent claim 1.

Accordingly, Applicants respectfully submit that independent claim 1 is allowable over Feygin in view of Schmidt. Because claims 7-9 depend indirectly from independent claim 1, and include all of the limitations thereof, Applicants respectfully submit claims 7-9 are allowable as well.

Moreover, amended claim 7 recites that the “counter-rotating roller is skewed with

respect to a radius of the rotary annular build drum to induce excess build material to migrate over an inner edge of the annular build drum.” As shown in FIG. 2 of Schmidt, and not otherwise described, the planarizer 32 appears to be square with the platform 14. Schmidt is silent with respect to skewing the planarizer 32 with respect to a radius of the platform 14. Schmidt is also silent with respect to the shape of the platform 14, although the platform 14 appears to be rectangular in shape, which would be consistent with the operation of the apparatus described by Schmidt. As such, the platform 14 of Schmidt does not have a radius or an inner edge. Accordingly, Schmidt fails to teach or suggest a counter-rotating roller skewed with respect to a radius of the rotary annular build drum to induce excess build material to migrate over an inner edge of the annular build drum, as recited in claim 7.

In addition, amended claim 8 recites a “sensor disposed below the inner edge of the annular build drum to detect an amount of the excess build material.” Schmidt does not disclose the use of a sensor to determine an amount of excess build material. The Office action, at page 8, refers to col. 17, ll. 10-17 as disclosing a sensor to detect waste; however, Schmidt only describes opening and closing valves 74 to transfer waste material 76 when the curable phase change material 22 is delivered to the printhead 24. See col. 16, ll. 30-45, and FIG. 2, of Schmidt. The apparatus of Schmidt does not include a sensor and does not detect an amount of excess build material. Additionally, as discussed with respect to claim 7, Schmidt does not disclose an annular build drum and, therefore, does not have an inner edge.

Accordingly, Applicants respectfully submit that amended claims 7 and 8 are independently allowable over Feygin in view of Schmidt.

Applicants respectfully request reconsideration and withdrawal of the rejection of claims

7-9 under 35 U.S.C. § 103(a) as being unpatentable over Feygin in view of Schmidt.

7. Claim 15 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Feygin in view of Gothait. Applicants respectfully traverse this rejection as applied to the claims, as amended.

Gothait appears to disclose 3D printing systems and methods that utilize at least two printheads to dispense at least two different interface materials, each printhead dispensing an interface material of a different hardness. Col 1, l. 61, to col. 2, l. 14, and col. 5, ll. 30-38, of Gothait.

Applicants respectfully submit that the disclosure of Gothait fails to cure the deficiencies of Feygin with respect to independent claim 1, as outlined in section 2 above. Specifically, Gothait also fails to teach, suggest, or motivate one skilled in the art to contemplate a “rotary annular build drum for receiving successive layers of a build material therein” and an array of at least one printhead, where “the at least one printhead is configured for selectively dispensing droplets of a liquid binder onto the build material.”

Applicants, therefore, submit that neither Feygin nor Gothait, alone or in proper combination, provides the teaching, suggestion, or motivation for one skilled in the art to arrive at Applicants’ invention, as recited in amended independent claim 1.

Accordingly, Applicants respectfully submit that independent claim 1 is allowable over Feygin in view of Gothait. Because claim 15 depends directly from amended independent claim 1, and includes all of the limitations thereof, Applicants respectfully submit claim 15 is allowable as well.

Applicants respectfully request reconsideration and withdrawal of the rejection of claim 15 under 35 U.S.C. § 103(a) as being unpatentable over Feygin in view of Gothait.

8. Claim 21 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Feygin in view of EOS. Applicants respectfully traverse this rejection as applied to the claims, as amended.

EOS appears to disclose a device for manufacturing 3D objects by laser sintering. The device includes a container 1 with a platform 2 and a plate 20 disposed therein. See FIG. 1, of EOS. The plate 20 appears to be able to receive multiple build platforms 21 thereon. The build platforms 21 can be secured to the plate 20. See FIG. 2.

Applicants respectfully submit that the disclosure of EOS fails to cure the deficiencies of Feygin with respect to independent claim 1, as outlined in section 2 above. Specifically, EOS also fails to teach, suggest, or motivate one skilled in the art to contemplate a “rotary annular build drum for receiving successive layers of a build material therein” and an array of at least one printhead, where “the at least one printhead is configured for selectively dispensing droplets of a liquid binder onto the build material.”

Applicants, therefore, submit that neither Feygin nor EOS, alone or in proper combination, provides the teaching, suggestion, or motivation for one skilled in the art to arrive at Applicants’ invention, as recited in amended independent claim 1.

Accordingly, Applicants respectfully submit that independent claim 1 is allowable over Feygin in view of EOS. Because claim 21 depends directly from amended independent claim 1, and includes all of the limitations thereof, Applicants respectfully submit claim 21 is allowable as well.

Furthermore, amended claim 21 recites a plurality of rotary annular build drums. EOS appears to only be concerned with manufacturing multiple objects within a single container and, therefore, only discloses a single container capable of receiving multiple platforms therein. Thus,

EOS does not appear to teach or suggest multiple rotary annular build drums. However, a translation of the reference was not included with the Office action. Applicants respectfully request a translated copy of the reference if the rejection is maintained.

Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection of claim 21 under 35 U.S.C. § 103(a) as being unpatentable over Feygin in view of EOS.

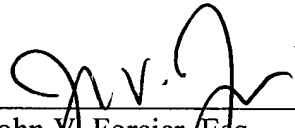
CONCLUSION

In view of the foregoing, Applicants respectfully request reconsideration, withdrawal of all grounds of rejection, and allowance of claims 1-26 in due course. The Examiner is invited to contact Applicants' undersigned representative by telephone at the number listed below to discuss any outstanding issues.

Respectfully submitted,

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